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EDITORIAL

Away back in 1883 a prominent member of the legal profession, and an M.P., remarked that "the medical education of women is now a recognized necessity." It was most certainly a remark that represented a minority of popular opinion and, for most of that minority, "necessary evil" could probably have been substituted without much criticism.

Our beginning was a modest one, at the Ontario Medical College for Women, with three undergraduates the first year. The story of the next few years,—the early struggle at a separate College, then admission of women gradually to some of the universities and established Medical schools,—reads like an epic that makes us, who follow in the well-blazed trail, extremely humble. We were admitted to the University of Toronto in 1906 with the understanding that we were to receive "equal rights and no privileges." This has, on the whole, obtained up to the present, at least during our undergraduate days. However, on approaching graduation, one finds that a remarkably small number of worth-while internships are available for women graduates. This is not entirely the fault of the hospital staffs, since we, as women physicians, have been unable to break down completely the traditional antipathy of many

patients. When a woman doctor makes a mistake, she is often criticised doubly; once for her mistake, and again for being a woman. We feel that much of the criticism directed at us is not for what we have done, but for what we might do, and we do object to being judged before trial. Our conception of a fair and adequate trial would be the opportunity of competing with men on a strictly equal basis for the highest positions of responsibility, not only in hospitals, but in municipalities as well. It has been said by many people that women doctors lack self-confidence. Would it be any wonder if we did? Complete and justifiable self-confidence can come only with experience, responsibility and a sense of achievement.

As undergraduates, we have been fairly and equally treated by faculty and students alike. As the women doctors of the future, we ask for opportunities to share, on an equal footing with the men, the responsibilties of the profession we have chosen.

WOMEN'S COLLEGE HOSPITAL.

The advent of a new star into the hospital firmament around College St. has aroused the interest of the undergraduates in Medicine, the women in particular. For us, it represents another milestone on the road of achievement and holds out a promise of greater opportunities ahead of us.

The work started as an Out Patient Clinic in 1896, and it was not until 1912 that it was unofficially opened as a hospital by admitting one patient to the room fitted up in the basement of the Women's Medical College. Growth was rapid. In 1914, the Rusholme Road Hospital was opened with twenty-five beds and a training school, which included two student nurses. 1918 saw fifty beds and twenty-five cribs, and a decade later, the Out Patient Department was moved to Grenville Street. Its attendance numbered 7,215 visits in that year, and has increased to about 30,000 now. There are approximately seventeen different clinics.

The new hospital is the result of many years of effort on the part of officials and interested associates, and certainly, it is all that one could ask for in convenience, modernity and comfort. It is a general hospital, in all respects like other general hospitals, and men can bring their patients into the private and semi-private rooms equally with the women in the city. Nor is there any law against male patients! The only admission requirement of the hospital is that the patient be sick and in need of care.

There are one hundred and forty beds in the hospital as it stands now, and sixty infant cribs, but the hospital has been designed with a view to expansion. The public wards contain three, four, five or six beds, and have been filled continually since the new hospital was opened. There are eight excellently designed operating rooms, and four case rooms, each of the latter with a labour room. There are forty-five women doctors on the staff, and a very competent consulting staff, drawn from the various hospitals in the city. The hospital also maintains six internes, twenty staff nurses and about fifty-five student nurses. It was, incidentally, the first hospital in Toronto to introduce eight-hour nursing duty, and results have been very satisfactory in the short time this has been in effect.

The Women's College Hospital is unique in Canada in that it is staffed and managed entirely by women, and the fact that it is a growing concern, with a new hospital completely paid for and doing excellent work bespeaks its continued success.

The congratulations of the women undergraduates are extended to Dr. Jessie Gray, who has recently been awarded a three-year Gallie Course in Surgery. Dr. Gray graduated in 1934, took a Junior Rotating Internship at the Toronto General Hospital, and during this past year has been one of the two seniors in Obstetrics and Gynaecology. This is the first time that a woman has ever been allowed to take this course. We wish her all success!

BLEEDING IN THE THIRD TRIMESTER AND POSTPARTUM HAEMORRHAGE

By JESSIE C. GRAY, B.A., M.D. and ELAINE CUNNINGHAM, M.D.

Bleeding in the third trimester of pregnancy is always of great importance because of the serious consequences if not investigated as to cause and properly treated. In no case may it be regarded as normal. Placenta Praevia and Accidental Haemorrhage are the chief types of prenatal bleeding of late pregnancy and these only will be discussed in this paper, which will also include Postpartum Haemorrhage.

Accidental Haemorrhage

This condition is known by a variety of names, including Abruptio Placentae, Premature Rupture of the Placenta, and Uterine Apoplexy. It is defined in standard text boks as "the premature separation of the normally implanted placenta"

Throughout this paper figures of the occurrence of these various abnormalities are given. In no case must they be taken as fixed. The great amount of elasticity which must be allowed is due to the fact that various authors quote widely divergent statistics based on data obtained at different clinics. Accidental Haemorrhage is taken to occur slightly less often than once in 500 cases. These can be again subdivided into partial and complete detachment of the placenta, the former being roughly twice as common as the latter.

Etiology.

Accidental Haemorrhage was once thought to be due to trauma, whence it derived its name. This is now conceded to be a rare cause of the condition. The vast majority of the cases show evidence of toxaemia, and to this is attributed the underlying pathology. When trauma does play a part, it is merely to cause slight separation of the placenta in the presence of some underlying disease. In chronic nephritis, placental infarcts and haemorrhages are common and these may be considered as early stages of Abruptio Placentae. So common is the association of Accidental Haemorrhage with albuminuric toxaemia that many authors actually class it among the toxaemias of pregnancy. Hence an explanation as to its nature and origin would lead us into a discussion of the etiology of eclampsia, which is a subject best avoided in a paper which is intended to be of reasonable brevity. Diseases of the endometrium and ovum are also cited as underlying causes of premature separation of the placenta. Hypertension, severe mental shock and other factors producing interference with the circulation may start haemorrhage. Sudden release of pressure on rupture of membranes in polyhydramnios, internal podalic version, insertion of hydrostatic bag or bougies; traction on a short cord, and other mechanical causes may obviously result in premature detachment of the placenta

Pathology.

The pathology of Accidental Haemorrhage is bleeding beneath the placenta, separating it, and also into the interstices between the muscle fibres of the uterine wall. As the uterus is distended by its contents it cannot contract to close the bleeding sinuses, and hence the haemorrhage continues. There are all grades of severity of the condition and the bleeding may or may not be manifested externally. Three types of cases are described, purely for purposes of clinical classification, because they do not in any way conform with a gradation of the severity of cases. These are: (1) Concealed haemorrhage, (2) Revealed haemorrhage, (3) A combination of these two.

Symptoms.

The severity of the symptoms in any case of Accidental Haemorrhage depends on the size and extent of the placental separation and haemorrhagic infiltration of the uterine muscle wall. The mildest symptoms in a patient with other evidences of toxaemia must be taken as danger signals not to be disregarded by the careful physician. In fortunate cases the first slight haemorrhage puts the patient into labour and a living child is delivered before any great uterine bleeding has occurred.

The chief symptoms are those of blood loss and shock, and these will vary with the cause, amount of placental separation, and whether the uterus goes into labour. Usually there is first a sudden severe pain, tearing in character and often referred quite accurately to the site of the placental separation. This gradually gives place to a dull ache with occasional colicky pains. Nausea and vomiting may or may not occur. In more severe cases this goes on to dizziness, faintness, dyspnoea, tinnitus, spots before the eyes and thirst. If bleeding is not stopped, prostration increases. The patient goes on to unconsciousness, delirium, twitching, coma and death. There is, of course, marked pallor, cold extremities, cyanosis and a falling blood pressure and haemoglobin. On examination, a tense abdominal wall is found and a uterus larger than corresponds with the term of the pregnancy. It often increases in size between examinations and is board-like in consistency. It is impossible to outline the foetus in cases of such severity that the uterus feels like a "road-side stone" and the foetal heart is not heard. The patient will state that movements have ceased. Even in severe cases, if strong labour pains are produced at once, the contractions will spontaneously deliver a dead child and the mother will be saved. But if the pains are weak, death of the mother from haemorrhage and shock is all too likely.

Partial premature separation of the placenta in the second stage of labour occurs not infrequently and gives rise to signs of foetal distress. This, of course, calls for prompt delivery of the child, but the mother is in no grave danger.

Differential Diagnosis.

The differential Diagnosis of Accidental Haemorrhage is chiefly from Placenta Praevia, Rupture of the Uterus, Extra-uterine Pregnancy and Non-obstetrical Mechanical Catastrophy to any Abdominal Viscus. The differentiation is gone into in all text books, usually with useful charts of synopsis, so no more mention will be made here of the chief points of distinction. .

Prognosis.

In so far as figures are of any value, it may be said that in cases of complete separation of the placenta, there is a 50% maternal mortality rate, and that 95% of the babies are lost. However, the prognosis is much more favourable in the lesser degrees of separation.

Treatment.

The distinction of severe cases from the mild and moderate ones is most important when we come to consider treatment. Mild cases which occur toward the end of labour must be distinguished from low-lying placenta, laceration of the cervix and rupture of the uterus. They are treated, as stated before, by rapid delivery of the child. Moderate cases are treated conservatively. The chief features are measures instituted to combat shock—sedatives, heat, and intravenous or transfusion. Rupturing the membranes relieves some of the distension of the uterus and allows the uterine muscle a chance to regain its tone. This is aided by the application of a tight abdominal binder. Once shock has been controlled, labour may be induced by a gentle medical induction. Some authors advise the use of a hydrostatic bag to ensure rapid onset of labour. But it must not be forgotten that such a procedure increases the distension of the uterus, and the balance between this unfavourable feature and the desirability of delivering the patient as soon as possible must be carefully considered.

There are two distinct trends of

opinion with regard to the treatment of severe cases of Accidental Haemorrhage. One is radical, demanding the emptying of the uterus in whichever way is considered most advisable, depending on the state of the cervix. If Caesarean section is performed, it may or may not be followed by hysterectomy, depending on how completely the uterine muscle is riddled with haemorrhages. The other school of thought puts up a strong argument for conservative treatment in that, a patient already severely shocked by the infiltration of the uterus with blood, is in very poor condition to withstand operative measures. In almost all cases there is only the life of the mother to consider. Hence whichever type of treatment seems to give her the better prognosis, is the one to be adopted in each individual case.

Placenta Praevia

Placenta Praevia is also called Unavoidable Haemorrhage Near Term, because in this condition the placenta lies wholly or in part within the zone of dilatation of the uterus. Consequently the advancing presenting part cannot fail to cause some separation of the placenta, with resultant haemorrhage.

There are three types of Placenta Praevia, defined at this school as:

(1) *Central*—where the internal os is completely covered by placenta.

(2) *Marginal*—where the birth canal is partially occluded by the placenta when the cervix is fully dilated.

(3) *Lateral*—where the margin of the placenta just reaches the edge of the birth canal when the cervix is fully dilated.

This classification does not conform exactly with all the text books, but is the one used by the staff of this hospital. Some authors interchange the definitions of Lateral and Marginal Placenta Praevia as given here.

To be normal the lower margin of the placenta must not be within 10 cms. of the internal cervical os. If it is outside this limit, but is below the upper border of the isthmus, it is called "low-lying" placenta.

Etiology.

Placenta Praevia occurs roughly once in a thousand cases. It is ten times as common in multiparae as in primiparae. Generally the predisposing cause of low implantation of the ovum is general loss of uterine tone as occurs after numerous pregnancies, twins, chronic endometritis, etc. Some authors lay stress on "low nidation power" of the ovum, comparing placenta praevia with its opposite, ectopic gestation, in which the ovum has an abnormally high nidation power, except in those cases where there is some pathology of the tube deterring the passage of the ovum through it.

Symptoms.

The pathognomonic symptom of placenta praevia is painless bleeding in the third trimester. The severity of the haemorrhage and its occurrence near to or far from term depends to some extent on the degree of praevia. If the placenta is central, the first haemorrhage is apt to be severe and some time before the patient is due to go into labour. With lesser degrees, the first bleeding may be merely spotting, and in cases of lateral placenta praevia, there is often no bleeding until the patient begins to have labour pains. In no case, however, must painless bleeding in the third trimester be considered lightly because bleeding stops only to recur with increased severity. These patients usually give a history of being unusually well throughout their pregnancy. There is no toxaemia, the placenta is not infarcted and the baby is usually alive.

The findings in the typical case who gives a history of one or recurrent painless haemorrhages are as follows: On abdominal examination, the baby is found alive, but frequently in abnormal position — breech, transverse presentation or with an extended head. The presenting part is unengaged and riding high. On vaginal examination, there is

a bogginess in the fornices and the presenting part is hard to reach. The cervix is usually not taken up, but if one finger can be passed through it, the placenta may be felt between the presenting part and the examining finger. If not, then the finger should be swept around within the internal os to determine the degree of praevia. Even vaginal examination is not conclusive, however, as in cases of low-lying placenta verging on lateral placenta praevia, the placenta is not infrequently out of reach of the examining finger.

Differential Diagnosis.

Varicose veins of the vagina, cancer of the cervix and other causes of bleeding in the lower genital tract can be ruled out on examination. In bleeding due to rupture of the uterus, there is a history of abdominal trauma or else of a long obstructed labour, and on abdominal examination, the uterus can usually be felt as a small, contracted knob to one side of the foetus, which has ruptured through it. The chief condition which must be differentiated from Placenta Praevia is Accidental Haemorrhage. The points of difference in these two conditions are usually well tabulated in the text books, and it will not be necessary to go into them here. Suffice it to say that Accidental Haemorrhage is primarily a toxaemia with albuminuria, hypertension and a history of oedema. There is also marked tenderness of the uterus at the site of the haemorrhage and the baby is not uncommonly dead. The patient is also usually in labour. Placenta Praevia, on the other hand, is a purely mechanical disaster in a patient who has had a normal prenatal course. She is usually not in labour and the baby is not distressed.

Treatment.

The proper treatment of Placenta Praevia is such an important and serious matter that a large section of any text book on Obstetrics is devoted to it. The methods of treatment of this accident of pregnancy are more clearly defined than for Accidental Haemorrhage. But individual factors must always be considered in every case, namely: the surroundings of the patient, condition of mother and child, religion, type of placenta praevia, whether patient is in labour or not, degree of dilatation of the cervix and other circumstances which make the life of the child particularly valuable, as in elderly primiparae.

The patient should be hospitalized where at all possible. If the patient is within reach of a good hospital, and is not a marked degree of placenta praevia, it may be possible to keep her at home, provided that there are suitable donors, already cross agglutinated, always within call, instruments for transfusion kept in the house, and the patient warned never to be alone, even for a few minutes.

On admission to hospital the patient should be typed and suitable donors procured before a vaginal examination is performed, because profuse haemorrhage may be precipitated. Subsequent course will depend on the individual factors outlined above.

If the patient is in labour the first objective is to control haemorrhage. With lateral placenta praevia the bleeding occurs toward the end of the second stage, is slight, and is controlled by rupturing the membranes, which allows retraction of the placenta with the lower segment. The head then usually comes down and exerts pressure on the placenta. If the cervix is fully dilated labour is terminated at once by forceps, version or extraction.

The usual circumstances met with are profuse bleeding with slight dilatation of the cervix with or without uterine contractions. In this case there are three methods of treatment available; Braxton-Hicks version, Hydrostatic Bag or Caesarean section.

Braxton-Hicks version is the pulling down of a foot so that the baby's thigh exerts pressure on the placenta, controlling the haemorrhage. After this has been done the case is left to nature until the cervix is sufficiently dilated for delivery. This method is preferred

where the patient has had excessive blood loss or the baby is dead, dying or very premature. It is applicable only where there is sufficient dilatation of the cervix to allow the passage upward of a hand to draw down the baby's foot.

The introduction of a hydrostatic bag is applicable where the condition of mother and child is good and the blood loss has not been too great; or where the cervix is not dilated sufficiently to deliver the child or to allow the passage of a hand into the uterus. A bag is inserted by the usual method and only enough traction is put on it to control haemorrhage by pressure of the inflated bag on the placenta. Pains will come on, usually within an hour. The patient must be carefully watched to determine the degree of advancement of the bag and dilatation of the cervix. After the bag has been expelled the presenting part may follow it down and exert pressure on the placenta in the same manner and hence control haemorrhage. If not, then the head must be pushed down until forceps can be applied, or else podalic version must be done. The delivery must not be hurried and the use of pituitrin is not advised, even if the infant has to be sacrificed, because of the danger of rupture of the lower uterine segment weakened by the placental attachment. The treatment of bleeding from the low placental site at the end of the third stage, is just the treatment of postpartum haemorrhage from any cause and will be discussed later.

Caesarean section is indicated in any case where a diagnosis of central placenta praevia is made definitely. It is also used where there is a lateral placenta praevia at or near term with both mother and infant in good condition and the cervix closed.

If a placenta praevia has to be delivered at home in the usual poor conditions of average home obstetrics, Braxton-Hick's version with slow spontaneous delivery is considered the best method of treatment.

Postpartum Haemorrhage

Under this term is grouped all bleeding occurring after the birth of the child and within the term of the normal puerperium. The average loss of blood during labour is 8 to 10 ounces and any loss over a pint is to be considered pathological.

Etiology.

There are three prime factors to be considered under etiology:

(1) Lacerations of the birth canal, special attention being paid to those of the lower uterine segment, which is particularly apt to occur after placenta praevia, and of the cervix.

(2) Diseases of the blood or blood vessels as in purpuric states, scurvy, syphilis, toxaemia and sepsis.

(3) Disturbance of the normal mechanism for the control of haemorrhage, namely the physiological contraction and retraction of the uterine muscle. This is known as uterine atony. There are both general and local causes of this disturbance. Among general causes may be placed exhaustion from prolonged labour and the excessive use of anaesthetics. Of the local causes the following are chief: over-distension of the uterus as in multiple pregnancies or polyhydramnios, accidental Haemorrhage, distortion of the uterus as from fibroids or scars, chronic endometritis, retained placenta or secundines, placenta accreta and improper obstetrical procedures such as too rapid delivery, premature expression of the placenta under an anaesthetic, traction on the cord, etc.

Symptoms.

The symptoms are those of blood loss. The haemorrhage may be chiefly internal or chiefly external or a combination. If the bleeding is from laceration of the birth canal, the fundus is usually hard, but if from atony of the uterus, the fundus is high, flabby and difficult to palpate. In making a diagnosis as to the source of postpartum bleeding, one must consider the

likelihood of lacerations in forceps and other operative procedures. Vaginal examination should locate the site of bleeding in these cases. The placenta should always be carefully examined after delivery to make sure it is intact.

Treatment.

Most postpartum haemorrhages are avoidable and the best treatment lies in prophylaxis by paying careful attention to the patient's history and procuring the full benefits of prenatal care, by conserving the mother's energy throughout her labour, avoiding too rapid deliveries, long anaesthetics, traction on the cord and premature expression of the placenta, and, in general, by the avoidance of "meddlesome obstetrics."

The first concern in the treatment of postpartum haemorrhage is to stop the bleeding. The second is to combat blood loss and shock. Where severe haemorrhage follows immediately on delivery of the child, the first step is vigorous massage of the uterus. When it contracts, bleeding usually ceases. If it continues, then internal examination must be made for tears. With continuous bleeding, the placenta must be removed, either by the Crede method or manually, whether there is a tear or not. Having removed all of the placenta, the uterus is massaged again and ergot and pituitrin given. If bleeding then continues bimanual compression of the uterus held in antiflexed position may be done while a hot intrauterine douche is being prepared. After the douche, packing of the uterus may be resorted to. Compression of the aorta and elevation of the foot of the bed are useful procedures. Operative control of the uterine arteries is used as a last resort. An intravenous of normal saline should be started immediately and a suitable donor obtained and the patient transfused as soon as possible. Other measures to combat shock should also be employed namely morphia for restlessness, hot water bottles and blankets.

Lacerations of the cervix, vagina and vulva that are bleeding should of course be sutured. Where this is impossible, packing may be employed to control further blood loss.

Patients who have had postpartum haemorrhages must be carefully watched for sepsis as their lowered resistance makes them good candidates for septic complications during the puerperium. As soon as possible they should be given iron tonics and diets specially designed for increased haemoglobin production. In suitable weather they should be put out in the sunlight and fresh air for the majority of their period in hospital.

Delayed or secondary haemorrhages occurring more than 24 hours after delivery are most commonly due to bits of retained placenta, membranes or even blood clot. Subinvolution of the uterus is next in importance, various causes being ascribed such as hyaline degeneration of the blood vessels or low grade intrauterine infection. Displacements of the uterus also play a minor role, the lochia remaining bloody for 6 to 8 weeks. Nervous upsets or sudden physical strain may cause a reappearance of the sanguinous lochia. Among the occasional factors are included fibroids, carcinoma, cervical erosions, unrecognized rupture of the uterus, secondary haemorrhage after suture of a cervical tear, puerperal sepsis with softening of the thrombi of the placental site, etc.

The treatment of such late puerperal haemorrhages is ergot by mouth, pituitrin ½ cc. by hypo q. 4. hr., massage of the uterus and ice bags. With persistant bleeding antiseptic packing of the uterus and vagina may be resorted to, but vaginal douches are to be avoided. Curettage is not to be attempted until the fifth or sixth week post partum.

MIGRAINE

J. A. McGEACHY, '37.

Headache is an ill common enough to the human race, but not every headache deserves the name of migraine. Migraine is a headache, but also much more. Typically, it is a periodic hemicrania, accompanied by psychic, visual and gastro-intestinal disturbances. It is frequently preceded by prodromata. Although, for lack of demonstrable cause and pathology, it cannot be called a disease, it can truly be called a devastating misery.

Aetiology

The aetiology is not definitely established, and therefore the theories of its cause are legion.

Hereditary Factor.

The hereditary factor is well established. The average conclusions of different authorities place heredity as being present in 75% of cases. There is some evidence for its transmission through the maternal line. Rarely more than one of each fraternity is affected. Some authors offer as an explanation of the hereditary factor, the anatomical conformation of the skull. Timme stresses a constriction or underdevelopment of the sella turcica. Touraine and Draper have classified this type of skull as slightly acromegaloid, with the face broad across the zygoma and maxilla, eyes set wide apart, well defined supra-orbital ridges and glabella, and slightly receding chin. However, they point out that acromegaloid characteristics are absent in other parts of the bony system, except for tapering fingers.

Constitutional Factor

A constitutional migrainous type was postulated by Touraine and Draper, who analyzed a series of 50 cases in whom were ruled out all demonstrable pathological conditions of eye, sinuses and brain, including tumor, lues or injury. They studied these people with a view to discovering whether they represented a special design of total personality. Their conclusions were that the migrainous patient did represent a "characteristic constitutional type, showing skull conformation with acromegaloid trends, intelligence outstanding, but emotional and psychosexual structure retarded in development." This constitutional type includes the acidotic children who frequently go on to develop migraine in later life.

Allergic Factor

Much work has been done to demonstrate evidences of the exudative diathesis in migrainous individuals. More than 70 years ago, Trousseau listed migraine with asthma, urticaria, eczema and hay fever. The first series was investigated from this point of view by Pagniez, Vallery, Radot and Nist in 1919. In 1923, Miller and Raulston obtained promising results with treatment of migraine by non-specific desensitization, along with dietary avoidance of foods producing positive reactions. Vaughan states that migraine is a symptom which no doubt may be due to a variety of causes, one of which appears to be allergy. If this be so, one would expect frequent occurrence of this symptom in individuals suffering primarily from other allergic manifestations. He undertook a survey of an entire rural community of 508 individuals, with the following interesting conclusions:

1. At least 7% of a homogeneous community was found to have suffered at one time or another from recurrent headaches, due to specific food.

2. True migraine is often due to food allergy. Upward of 70% of re-

current primary headaches without pathological conditions are associated with allergy.

3. Such headaches appear to be more frequent in allergic individuals than in people at large.

Rowe also investigated 86 cases of migraine due to food allergy where he found food dislikes or disagreements to be present in more than 75% of cases.

The fly in the ointment, however, in the allergic theory is that all investigators agree that the skin tests are unreliable. Vaughan places the positive skin tests in these cases at 50%, with emphasis on the importance of borderline reactions and of positive reactions from foods that are producing no symptoms. Rowe states that skin reactions are 24% positive when the allergen is food, and 10% positive when the allergen is some other substance. These results are in opposition to the reliability of skin tests in such allergic manifestations as asthma, eczema, etc.

The lists of offending foods reach such proportions that it is impractical to quote them all. Certain food elements however, stand out as being commonly to blame. Carbohydrates top the list, chief among which are wheat products, with chocolate coming next. Among fruits and vegetables are named cabbage, cucumber, apples, onions and bananas. Proteins, especially pork and eggs, are sometimes troublesome, as well as condiments and oils.

Endocrine Factor.

Timme emphasizes this factor, pointing to a derangement of almost any of the ductless glands, but chiefly to a pituitary inadequacy, due to a small and enclosed sella turcica. This takes us back to the skull formation of the constitutional migrainous type, but also may have a bearing on deranged carbohydrate metabolism. A probable hypoglycaemia has been mentioned as occurring in attacks. The occurrence of attacks with menstruation in many women, and their cessation at the menopause, would seem to point to some endocrine factor, the nature of which at present is undetermined.

Psychic Factor

Every writer on this subject, no matter to which causal factor he leans most, is sure to mention a psychological disturbance as preceding any physiological one which he may demonstrate. These participating factors run the whole gamut of emotional and personality imbalance—inability to face new situations, a sense of insecurity, self pity, assumption of unnecessary burdens and responsibilities, marital and sexual difficulties, frustrations, fears (of all kinds, including religious ones), economic worries, etc., etc. The precipitating psychological factor may always be the same, as it may be an emotional reaction which was originally attached to a certain difficulty and which recurs under periods of strain, even when the original situation no longer exists. On the other hand, it may be a different factor for each attack. This sequence can be determined in the individual case by careful inquiry.

A resume of these aetiological factors clearly shows that there is no composite idea of cause. The fortunate few may be able to point to a definite personality problem or food idiosyncrasy, but for the majority, the cause lies hidden under our massive ignorance of the sudden throwing out of order of the delicate balances within central and sympathetic nervous systems and endocrine glands.

Occurrence

The occurrence is world-wide, although Cheyne in 1933 referred to migraine as the "English malady."

It is two or three times commoner in women than in men, the attacks in women being both longer and more severe. It usually begins at an earlier age in women. There is a total greater incidence in both sexes before the age

of 30 years, although it may begin in either sex in childhood, as early as 5 years.

Periodicity

Periodicity is typical and can be established by the patient. The following types can be clearly defined:—

a) occurring only at menstrual periods. It is significant here that migrainous women are usually free from headaches when pregnant and after the menopause.
b) occurring at menstrual periods and also at other times. In these cases there is not such constant relief during pregnancy, although relief is universal after the menopause.
c) occurring in relation to constipation.
d) occurring with eating of certain foods in allergic cases.
e) occurring with worry or mental shock. Here the first attack may have been precipitated by some upsetting event, and the attacks recur with a certain periodicity thereafter. Certain days are "headache days" for some people, e.g. Sunday morning for the business man, Fridays, Mondays, etc., each particular day bringing the recurrence of some strain or special degree of fatigue. Here the element of expectancy is strong in influencing the periodicity.
f) occurring in travelling to a place with unpleasant associations.

The frequency may vary from one attack every one, two, four or six weeks, to two or three attacks a year. However, for each patient, the periodicity has a definite pattern.

Pathology and Associated Diseases

No pathological change typical of migraine has ever been demonstrated, which parallel our incomplete knowledge of cause. Also, there is no typical association with other diseases. In fact, to diagnose migraine accurately other diseases of eyes, ears, sinuses, brain, etc., must be carefully ruled out. Some authorities have classed epilepsy with migraine in a family strain (Buchanan and Stevens). The allergy proponents, of course, pointed to the association of asthma, urticaria and eczema, although it is noteworthy that they have not the same positive skin test to rely on in migraine, as they have in these other diseases. Recently a number of workers have pointed to an associated liver dysfunction, cholecystitis or cholelithiasis (McClue and Huntsinger, 1927); and to duodenal stasis and intestinal toxaemia (Harstock, 1927). However, there has been no conclusive proof that these conditions are not merely co-incidental instead of causal, from a pathological point of view.

Symptoms and Signs.

The typical story is that of a "sick headache" or "bilious headache." The attack begins suddenly, is frequently heralded by prodromata, reaches a zenith of prostrating pain, accompanied by nausea, vomiting, vertigo, tinnitus, extreme malaise, transient scotomata, mental depression and transient pareses, paraesthesias, or aphasias. The pain is typically unilateral and may be located frontally or temporally, going down over one eye or behind both eyes. However, it may also be bilateral, occipital, going down the neck, and parietal or frontal. The pain is described as splitting or blinding, and a casual step in the room, a touch on the bed or a flash of light, or turning the pages of a book, is intolerable. This may last from a few hours to one, two, three days, or even in unusual cases, a week. When nausea and vomiting occur, the pain usually diminishes greatly, the patient falls into a deep sleep and on wakening, the pains and accompanying disorders are quite gone.

Prodromata vary and can usually be recognized by the patient. A common one is a craving for sweets and car-

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bohydrates. Others are constipation, lethargy, fatigue and vague feelings of impending malaise for some hours before the pain begins. Frequency of micturition is sometimes noted in the attacks.

The attacks are accompanied by no fever or leukocytosis, but there may be a temporary eosinophilia. The pulse is slow. Spasm of the retinal vessels has been seen in attacks.

The mechanism of the pain is thought to be a spasm of vessels, followed by a sudden dilatation.

Treatment.

The treatment varies as widely as the theories of cause. For the milder and shorter attacks, repeated doses of such analgesics as aspirin, phenacetin and codeine may allay the pain. For the severe attacks, none of the known analgesics has the slightest effect. Morphine not only does not always relieve the pain, but is strongly contra-indicated because of the danger of habit formation. Vasodilators are used with benefit in some cases, in the form of nitrites, or trichlorethylene, which is the most recently recommended. Twenty to thirty drops of trichlorethylene are dropped on a handkerchief and inhaled, not being held too close to the nose. This is inhaled while lying down. Its action is thought to be similar to that of amyl nitrate in the relief of angina pectoris. Nickum, working on the theory of a probable hypoglycaemia occurring in attacks, used 1 c.c. of 1:1000 solution of adrenalin chloride, together with some form of increased sugar intake, with distinct allaying of symptoms in some and prevention of attacks in others of a series of 32 cases.

Ergotamine tartrate given intravenously or hypodermically was found to abort attacks in 35 patients investigated at the Neurological Unit of the Boston City Hospital in 1934.

Collip's extract of placental hormone (Emmenin) taken in small doses for periods of one to two weeks at in-

tervals has been effective in preventing attacks in some cases, and in increasing the interval between attacks. An objection to this therapy in women is the production of menorrhagia, even when the administration is omitted during and just previously to a menstrual period. However, it has been very useful in the cases of some men.

Thyroid therapy has also been used with some success in attacks.

Surgical intervention by Dickenson, who divided the middle meningeal artery and nerve, gave good results in seven cases.

The induction of an artificial menopause by radium has abolished attacks in women where every other palliative measure had failed.

Considering the ineffectiveness of the analgesics, the use of a barbiturate, such as luminal or nembutal, gr. 1½, is sometimes a very good thing in hastening the deepeningof the sleep, which will terminate the headache. A daily therapy of luminal, gr. ½, three times a day is also effective in some cases, in delaying attacks and lengthening the interval.

The long and short of drug treatment is that some drugs are effective for one and not at all for another person. Nothing is specific and what is an effective agent for one attack may not be for another attack in the same individual.

More hope is held out by general physical and mental hygiene than by drug treatment. The patient should have a regulated and wholesome regime of activities, diet and sleep. He should be educated to recognize the signs of strain and fatigue in himself and to stop short of the point of precipitating an attack. Tactful and sympathetic inquiry may reveal the existence of some maladjustment in the social or mental life, which forms an adequate precipitating factor, and which if removed may do much to ameliorate symptoms. Above all, he should be encouraged to indulge in hobbies and recreation, as frequently this type of patient, faced with the inevitable recurrence of attacks for the rest of his life, develops deep-seated fears and may go into a state of profound depression. Such cases have sometimes resulted in drug addiction and suicide.

Prognosis

Attacks are never fatal and there is no reference in the literature to the effect of migraine on length of life. Attacks diminish in severity and frequency as age advances. They disappear almost always in women during pregnancy and after the menopause. Actually, migraine can be considered as requiring a similar sort of adjustment of habits and manners of life as duodenal ulcer or healed tuberculosis. The individual is definitely limited in certain directions, but once he is acquainted with his margins of safety, there is no need for him to regard himself as a semi or complete invalid.

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RHEUMATISM IN CHILDREN

By PEARL SUMMERFELDT, M.B.*

Acute rheumatism in childhood is a common and serious disease entity. Its seriousness lies in the fact that it is the predominant cause of heart disease and chorea in children.

It is agreed that rheumatic fever represents the response of the body to an infecting agent. In 1900 Poynton and Payne isolated a streptococcus from cases of rheumatism. Since then, much has been published for and against the streptococcus being the causative agent but at present no one specific organism has been universally accepted. Recent workers have published reports on a virus being the cause of rheumatism, but it still remains to be proven. There is no direct evidence at present to indicate that it is an allergic reaction. Clinically it is a sequela of other diseases as tonsillitis, nasopharyngitis, scarlet fever and other infectious diseases. Also the presence of diseased tonsils have been looked upon as the foci of infection. In a series of 96 cases of acute rheumatic fever admitted into the Hospital for Sick Children, Toronto, from October 1929 to October 1932, the tonsils were present in 79 cases and in the great majority of these the tonsillar glands were enlarged. There was a preceding acute upper respiratory tract infection in 32 cases, which occurred in the majority of cases 10 to 19 days before the arthritis, but in some cases only a few days elapsed between the preceding infection and the joint involvement. In one case scarlet fever, in one case diphtheria, and in two cases influenza preceded the onset of the rheumatic fever. Schlesinger and Paterson in their series found in the majority of cases that rheumatism occurred 10 to 21 days after a throat infection.

Besides the influence of infection on the occurrence of rheumatism there seems to be an environmental factor. This is made apparent by the fact that it is a disease of the poorer classes living in the cities; that in 24% of the cases in our series there were close relatives suffering from the same condition. It occurs most frequently in the winter and damp months of the year.

Juvenile Rheumatism occurs rarely before three years of age. In this series there were 5 children in the three year age group. The greatest number of cases—87—occurred between the ages of 6 and 12 years. Girls affected predominated over boys, there being 56 girls and 40 boys.

It is well recognized that childhood rheumatism differs from that occurring in the adult. Rheumatic fever in the adult is manifested by extreme joint involvement with little or no heart disease. In children the joints suffer less and the heart more.

The rheumatic children seen at the hospital may be conveniently divided into three groups. The first group comprises the ambulatory cases that attend the out patient clinic only. They come because of tiredness, debility, pallor and frequent upper respiratory tract infections. Associated with this there are the so-called growing pains which occur chiefly in the calves of the leg, behind the knees and in the arms. Occasionally there is pain over the praecordium or in the neck. The pains occur chiefly in wet weather, sometimes keep the child awake at night and are made better by rest in bed and salicylate therapy. In the majority of cases this type usually clears up leaving no aftermath. In a

* From the Hospital for Sick Children, and the Department of Paediatrics, University of Toronto, under the direction of Alan Brown, M.D., F.R.C.P.(C).

small percentage arthritis develops 6 months to 5 years after the first growing pains, as it did in about 8% of the cases. Involvement of the myocardium develops in less than 5% but seldom becomes very severe or progressive.

The next group comprises the cases admitted into the hospital with a diagnosis of acute rheumatic fever. There were 96 such cases in the three year period quoted. In 58 cases the joints were painful and red, while in 38 cases there was definite redness, swelling and extreme pain of a few joints, as knees, ankles, wrists and elbows. This type of case resembles the adult type in degree but not in the number of joints involved. On the administration of salicylates the articular manifestations cleared up in 1 to 8 days, usually requiring 3 to 5 days to disappear. A sharp febrile reaction, 102^0-104^0 just precedes or occurs with the arthritis. This lasts only a few days but in the majority of cases is followed by a low grade fever which will last from a few weeks to months. During this phase the pulse is elevated to 120-140 but quickly falls to 98-110 as the fever subsides. During the low grade febrile course the pulse is usually moderately fast, and is unstable.

The physical appearance of the child is that of a sick child, pale and tired looking though fairly well nourished. Tonsils are diseased and liver may be enlarged. There are complaints of tiredness, headache, abdominal pain, epistaxis, excessive perspiration, irritability, vomiting and pain in the chest.

The accompanying myocarditis is the most serious part of acute rheumatic fever. In 74 cases, or 77% of this series, there was involvement of the myocardium. Invasion of the myocardium occurs early and can be detected clinically within a few days of the onset of the arthritis. On clinical examination of the heart dilatation is not marked. In the early phase a short soft systolic murmur is heard at the apex while the pulmonic second sound is accentuated. This may gradually clear up or there may develop reduplication of the second sound, a mid-diastolic or soft presystolic murmur internal to the apex without a thrill. The outcome of this myocarditis varies.

Of the 74 cases, or 77%, with clinical evidence of carditis, 28, or 38%, had no cardiac involvement on discharge and had no recurrence of any murmur over a period of 1 to 3 years. In 6 other cases, or 8%, with no murmur on discharge there was at infrequent intervals a soft apical murmur heard in the cardiac clinic. In 22 cases, or 30%, there was a residual mitral regurgitation but in 5 cases this cleared up in 1 to 3 years; also in this group of 22 cases there were 4 who developed a mitral stenosis in approximately 2 to 3 years. With this there was frequently an aortic regurgitation. Mitral stenosis was diagnosed in 7 cases, or 9%, during their stay in hospital but in these cases there had been a history of more than one attack in a long period of frequent sore throats and growing pains. Pericarditis occurred in 6 cases. Other heart irregularities are rare in children but fibrillation, flutter and heart block occur at times. During this period there were no skin rashes or subcutaneous nodules. Chorea occurred in three cases. Two children had more than two attacks of acute rheumatic fever while 5 children had a second attack. There were no respiratory complications except in the cases of pericarditis.

During the active joint period the W.B.C. varied from 9,000 to 15,000 with a leucocytosis. As a rule there is a mild degree of anaemia, the haemoglobin being between 70 and 75%.

The differential diagnosis is very simple. At times appendicitis has been diagnosed in those suffering with involvement of the right hip. Rheumatoid arthritis in children begins in a certain number of cases with a painful polyarticular swelling. In these cases there is no response to salicylates and the condition continues for weeks. Septic arthritis and multiple osteomyelitis has

to be considered at times but usually the W.B.C. is much higher with a greater degree of leucocytosis, while the child appears very toxic.

The third group is comprised of those cases admitted with a reinfection of the myocardium frequently following an upper respiratory tract infection, or in cases where the diseased tonsils had not been removed previously. There was no immediate preceding arthritis. In the period studied there were 130 of these cases. It is in this type of case that one recognizes the seriousness of rheumatism in childhood and its crippling effects on the life of the child. To prevent this degree of cardiac involvement removal of foci of infection, good hygienic care, and close supervision of the rheumatic child is required.

Course, Prognosis and Treatment

This depends entirely upon the degree of heart involvement. In cases with no heart involvement the child is usually up and about in 8 to 12 weeks. Tonsils and adenoids were removed in the 4th to 6th week. In cases of moderate cardiac involvement tonsils are removed as soon as the temperature has been normal for at least two weeks and the pulse has been steady.

The preventive treatment of rheumatism is extremely important. Where living conditions are congested and damp the family should move to the outskirts of the town, preferably in a dry locality and where there is plenty of fresh air. The mother should be instructed regarding warm clothing, plenty of rest, sensible nourishing food, and the prevention of upper respiratory infections. Class I and potential cardiacs should be allowed to live as normal children. Removal of foci of infection is necessary as, following a tonsillectomy, children are less apt to have recurrent colds. Rest in bed is advocated if the child appears pale or tired at any time.

During the acute phase sodium salicylate grs. X q 4 h x 4 with bicarbonate of soda grs. V is administered. This should continue for at least two weeks after all signs of infection such as low grade fever and rapid pulse have subsided. In the majority of cases treated in the hospital salicylates are given practically throughout the entire stay. With this treatment the heart rate is not as rapid and the variation in temperature is not as marked. Empirin grs. V q 4 h x 4 is recommended in cases of growing pains. In cases of active arthritis oil of wintergreen may be applied. The bed clothing is kept off the affected joints and warmth applied. In extreme pain codein is often useful. During the convalescent stage the child is given a good diet including minerals, vitamins and high calories. The anaemia does not respond to iron medication and often a small transfusion is beneficial in the more severe anaemias.

The child is allowed up even though a murmur is present when all signs of myocardial infection have disappeared, on condition that the child appears and acts like a healthy child and the exercise tolerance is normal. On the first day he is allowed up five minutes and on each succeeding day an additional five minutes is allowed until he is up for one hour daily. During the second hour 15 minutes is added each day. A period of 4 to 12 weeks in bed is usually necessary in the mild and moderately severe cases, while in the severe cases a much longer period is allowed. For many weeks after, a rest is required in the afternoon. School is allowed for half a day at first and no strenuous exercise or competitive games allowed. Children with badly damaged hearts should receive extra-mural teaching which can be readily obtained in the larger cities. This removes the child from the temptation of entering games beyond his capacity and also lessens his chances of upper respiratory tract infection.

In this series there were 5 deaths either from pericarditis or heart fail-

ure associated with a myocarditis, mitral stenosis and aortic insufficiency. The death rate was 2.7% of all cases of rheumatic carditis, i.e. of group 2 and 3. Death in the first attack of acute rheumatism is rare and usually occurs in cases with repeated re-infection of the myocardium.

THE ADRENAL CORTEX

DOROTHY REDMOND, B.A., '36

The adrenal glands are two small flattened bodies which together weigh about ten grams in the healthy adult. Each lies on the medial part of the upper end of the corresponding kidney. Ontogenetically and structurally, the cortex and medulla of the gland are distinct from each other, and it appears that the two parts also differ functionally. Extirpation of one adrenal and destruction of the medulla of the other leads to no apparent deleterious effects in the animal living under laboratory conditions. Removal or destruction of both cortices, in the absence of the rare accessory cortical tissue, invariably causes death.

Destruction of the cortex in man, commonly by tuberculosis, leads to the fatal disease described by Addison in 1855. He gave the characteristic symptoms as "anaemia, general languor and debility, remarkable feebleness of the heart's action, irritability of the stomach, and a peculiar change of colour in the skin." The significance of these symptoms from the standpoint of interpreting the physiological disturbances which follow the loss of adrenal function has remained obscure. The indispensability of the adrenal glands for life and health was evident from Addison's observations and his report led to experimental studies upon animals by a number of investigators. Their results, in turn, led to the obvious suggestion that the adrenal glands either supply an indispensable internal secretion, or that they exercise a detoxicating function, destroying certain substances which, in the absence of the glands, accumulate in the body and cause death.

Resulting from the work of Oliver and Schafer in 1895, adrenalin was isolated from the medulla of the adrenal glands. The obvious inference followed that the lack of adrenalin, the known hormone of the gland, caused Addison's disease. Further experimental work showed that this idea was fallacious, and that the disease occurred due to lack of function of the adrenal cortex.

Results of Adrenalectomy in Animals.

Bilateral adrenalectomy in animals, followed by optimal post-operative care, gives rise to a typical picture of adrenal insufficiency and death in from one to two weeks. The picture is not ameliorated by adrenalin administration. The animal usually appears in normal health for the first three or four days, and then anorexia and lessened fluid intake develop suddenly, associated with a loss in body weight. The animal next shows spasticity of the hind legs, relieved at first by exercise, but later persisting and extending to the fore legs. Vomiting, diarrhoea and tarry fluid stools are frequently present as late manifestations, and the animal shows a clinical picture and blood changes similar to "shock," as seen in high intestinal obstruction. The body temperature and B.M.R. fall; the pulse rate rises, is often irregular and falls, terminally. The blood shows increased viscosity; there is increase in serum protein, total nitrogen, calcium, phosphorus, potassium and magnesium. Polycythaemia and leucopenia are found, with a relative lymphocytosis. Some species show a fall in blood sugar and a decrease in liver glycogen. A diminution of blood chlorides is a constant finding. At first there is a slight polyuria, according to some observers,

but this usually gives place to oliguria and, terminally, anuria. Death was the invariable result reported by all observers, unless the animal possessed enough accessory cortical tissue to maintain life.

Adrenal Cortical Extracts.

Much work has been done in the past few years, using various extracts of whole adrenal gland and of adrenal cortex. Results were indifferent in earlier years, but decidedly more encouraging, latterly. In 1927 Hartman and his co-workers used a saline extract of beef adrenals, from which most of the protein had been removed by iso-electric precipitation. When this extract, which he called "cortin," was injected into bilateraly adrenalectomized dogs, it resulted in survival for two to three times as long as the control animals.

In the same year, Rogoff and Stewart published results of experiments on adrenalectomized dogs, using their preparation "interrenalin," which they had extracted from dogs' adrenals with 0.9% salt solution and glycerine. The results are best shown in Rogoff's own words. Writing in 1931, he says: "After a number of attempts carried on over a period of years, we were finally able to demonstrate satisfactorily that certain extracts prepared from cortex, when introduced intravenously in small quantities, once daily, are capable of prolonging life in adrenalectomized dogs well beyond the maximum period of survival of control animals."

In 1929, Swingle and Pfiffner found that the active principle of the adrenal cortex could be extracted with lipoid solvents. The crude lipoid fraction was obtained with an alcohol-benzene extraction, as it was found that the hormone was stable in these solvents. In their earlier work this lipoid fraction was taken up in olive oil, and administered subcutaneously. This method was potent, producing survival up to 30 days, but it caused severe local irritation at the site of injection. Further work resulted in the purification of the extract by methods of fractionation. The lipoid fraction was treated with acetone, and the acetone soluble fraction was further purified by selective distribution between 70% alcohol and petroleum ether. The petroleum ether soluble fraction was inactive, while the alcohol soluble fraction contained the hormone along with some adrenalin and inert material, including appreciable amounts of pigment. Treatment with this fraction was very satisfactory, except for one thing. It was found that adrenalectomized animals were hypersensitive to adrenalin, and the 0.17 to 0.37 milligrams of adrenalin present in the crude extract was sufficient to induce physiological changes, such as elevation of the blood pressure, and a rise in blood sugar in the test animals. After further study and work, Swingle and Pfiffner elaborated a method for the removal of the adrenalin by passing the solution of the extract through permutit. The technique was complicated, but it accomplished the desired end, and experiments proved that the permutit fractionation left the hormone unimpaired, and made the extract suitable for subcutaneous, intraperitoneal, and intravenous use. When the extract is made up so that one cubic centimetre represents thirty grams of fresh cortex, the solid content is about 0.3% and the adrenalin content is about one part in one million. With daily small injections of the extract, adrenalectomized animals can now be maintained in normal health for years.

The chemical properties of the extract may be listed as:—

1. The hormone is thermolabile.
2. It is destroyed by saponification.
3. The extract gives a negative result to the Biuret, Hopkins-Cole and Molisch's reactions. Xanthoproteic and Millon results are positive.
4. The hormone retains its activity for comparatively long periods when left at room temperature, preserved with 0.1% benzoic acid.
5. It is stable in ethyl alcohol for a period of months.

Function of the Cortex.

Four main theories have been advanced as to the function of the adrenal cortex:

1. In 1932 Britton and Silvette published an article stating that the adrenal cortex prepotently regulates carbohydrate metabolism.
2. In 1932 Hartman et al. stated that it produces a "general tissue hormone.
3. In 1933 Swingle et al. said that it has a regulatory effect on the circulating blood volume.
4. A suggestion was made by Loeb, with later work by Harrop and his colleagues, that the cortex regulates sodium and chloride in the body.

Britton and Silvette also postulate a sex-stimulating hormone, which is not essential to life. It seems possible that there are more hormones than are in the cortex, but until large amounts of the hormone or hormones are available in crystalline form, the issue will remain confused.

Britton and Silvette removed the adrenals in various laboratory animals,—cats, rats, marmots and opossums,—and maintained them in apparently normal health by daily small injections of a cortical extract made after the method of Swingle and Pfiffner. By withdrawing the extract, they could very quickly cause the animals to go into marked adrenal insufficiency. They noted that the liver glycogen, muscle glycogen and blood sugar were all very markedly reduced; that epinephrine injections, or putting an adrenalectomized cat in the immediate neighbourhood of a barking dog produced almost no rise in blood sugar, whereas normal controls showed a 50-100% increase. They found that injecting sodium lactate into normal animals produced glycogen synthesis and storage in the liver, but the same amounts produced no storage in the adrenalectomized animals. Glucose injections in the normal produced a rise in blood sugar and considerable storage in the liver; similar injections in the adrenalectomized animals gave rise to a much higher blood sugar, but to no hepatic stage. They stated that the glucose and glycogen lack is progressively more severe after operation, and parallels the development of symptoms, and that the convulsions in adrenal insufficiency are identical with those in insulin hypoglycaemia. They readily admit that the carbohydrate factor is not the whole story, since glucose injections won't prolong life indefinitely, and the carbohydrate derangements are rapidly alleviated by adequate dosage with extract.

On the other hand, they believe that the decrease in blood volume is a late manifestation. By injecting saline or gum saline after symptoms of insufficiency had developed, they restored and maintained the blood volume fully, but did not prolong life. Their conclusions, as published in 1934, are:—

"That lack of cortico-adrenal hormone brings about in a gradual, progressive manner, a profound disorganization of carbohydrate metabolism. The general decomposition of the organism which follows adrenalectomy is apparently explicable on the basis of carbohydrate deficiency of a fundamental character. That the general condition of the animal brings about the carbohydrate disturbance is untenable."

Acceptance of this theory is by no means universal, and it has roused quite a good deal of protest.

Attention was first directed by Soddu in 1898 to the alleviating effect of fluid administration on the course of adrenal insufficiency in the adrenalectomized animals. He showed that symptoms in dogs were slightly relieved by saline injections and this was confirmed in 1926 by Banting and Gairns. In 1926, Stewart and Rogoff also prolonged life in dogs by injecting Ringer's solution with glucose, and in 1927, Marine and Bauman showed that isotonic sodium acetate was as effective as isotonic saline, but that isotonic glucose was ineffective. They concluded that the sodium ion was of primary importance. However, since hypertonic saline was not as effective, they decided that fluid administration was also important. Further work by

Bauman and Kurland in 1927 showed that the sodium and chloride levels in the blood were depressed in adrenal insufficiency, whereas all other ions were elevated.

Following up a suggestion by Loeb that the adrenals regulate sodium metabolism and renal function, Harrop and Weinstein reported in 1933 investigations of this aspect of the problem. When they withdrew the extract from healthy adrenalectomized dogs, they obtained an increased urinary output the following day, and marked increase in sodium and chloride excretion. Part of this fluid and salt loss is due to plasma loss, but most of it they believe to be derived from tissue fluids. They explain the lack of reduction in water content noted in liver and muscle tissue on the basis that potassium is the principle base here and not sodium. They were unable at that time to maintain animals on salt alone, but found that large amounts of salt reduced the amount of extract needed. They concluded that the state of "shock" in adrenal insufficiency is analogous to that collapse due to exposure to high temperatures, with great loss of salt and fluid through sweat. They believe that one function of the cortex is participation in the regulation of the sodium and chloride metabolism, and consequently of the balance and distribution of water. They postulate the kidney as the locus of this regulatory function.

In their most recent article, 1935, Harrop et al. report a group of experiments in which bilaterally adrenalectomized dogs have been maintained in normal condition for periods up to five months, by the administration of sodium chloride and sodium bicarbonate alone, keeping a normal concentration of both plasma sodium and chloride. If the chloride fell in these animals, anorexia and hypoglycaemia resulted. Fall in sodium produced haemoconcentration and dehydration. They reiterate their theory as regards cortical function and express the belief that the cortex has no direct influence on carbohyrate metabolism.

With regard to the clinical use of the cortical extract in the treatment of Addison's disease, its greatest value at present is in the alleviation of the crises which occur. In these circumstances, it is used with large doses of sodium chloride and fluid, intravenously.

At the present time, the entire question of adrenal cortex function or functioning is highly controversial. Extensive work is being carried on in many laboratories and the next few years should see remarkable advances in both the physiological and therapeutic aspects of the problem.

It is a pleasure to acknowledge the assistance of Dr. R. A. Cleghorn in the preparation of this paper.

"Stone walls do not a prison make Nor iron bars a cage."

Winter is a jailer who shuts us all in from the fullest vitamin D value of sunlight. The baby becomes virtually a prisoner, in several senses: First of all, meterologic observations prove that winter sunshine in most sections of the country averages 10 to 50 per cent less than summer sunshine. Secondly, the quality of the available sunshine is inferior due to the shorter distance of the sun from the earth altering the angle of the sun's rays. Again, the hour of the day has an important bearing: At 8:30 A.M. there is an average loss of over 31%, and at 3:30 P.M., over 21%.

Furthermore, at this season, the mother is likely to bundle her baby to keep it warm, shutting out the sun from Baby's skin; and in turning the carriage away from the wind, she may also turn the child's face away from the sun.

Moreover, as Dr. Alfred F. Hess has pointed out, "it has never been determined whether the skin of individuals varies in its content of ergosterol" (synthesized by the sun's rays into vitamin D) "or, again whether this factor is equally distributed throughout the surface of the body."

While neither Mead's Oleum Percomorphum nor Mead's Cod Liver Oil Fortified With Percomorph Liver Oil constitutes a substitute for sunshine, they do offer an effective, controllable supplement especially important because the only natural foodstuff that contains appreciable quantities of vitamin D is egg-yolk. Unlike winter sunshine, the vitamin D value of Mead's antiricketic products does not vary from day to day or from hour to hour.

DIAGNOSIS OF PULMONARY TUBERCULOSIS IN THE ADULT

M. F. BRAY, M.B.,
Mountain Sanatorium, Hamilton, Ont.

From the point of view of the sanatorium physician, one wonders why so many patients suffering from tuberculosis remain undiagnosed until they reach the stage of far advanced disease. The reasons for this lie, on the one hand, with the patient himself, and on the other hand, with the general physician. In regard to the patient himself, very often economic conditions interfere with his seeking medical advice when the first symptoms of disease become manifest. He usually continues to work until he is no longer able to carry on. On the other hand, with all due respect to the general physician, too often the early symptoms are treated too lightly and taken to be due to a cold or bronchitis. Another shortcoming of our profession is to look upon pleurisy too lightly, treating it with adhesive strapping and allowing the patient to return to work within a few days after the disappearance of fever and pain in the chest. Even hemoptysis, nature's danger signal, is too often disregarded and the patient allowed to return to his former activities after a short period of rest.

The purpose of this paper is to try to impress undergraduates in medicine with the importance of diagnosis in as early a state as possible, and to point out how best this can be done. Early diagnosis is of vital importance to the patient's future because far advanced disease is dangerous to life and even though the patient recovers he suffers permanent disability from extensive fibrosis of his lungs, while in early disease the mortality is low and the disability negligible, with a much shorter period of treatment.

What then are the methods we have at our disposal for diagnosing the early case? They are, first—History taking, second—Physical Examination, third—Sputum Examination, fourth—X-ray, and fifth—The Tuberculin Test. In some cases all five means are necessary to arrive at a diagnosis. This applies particularly to the early case, but in more advanced cases the problem may be solved much more simply and one or two of the methods may be sufficient.

History—A properly taken history will take into account the presence or absence of contact with the disease in either the immediate family or more remote connections. Occupation should be noted. The patient's complaint may include the presence of fatigue, loss of weight, fever, loss of appetite, cough, expectoration, hemoptysis, pleurisy, ischio rectal abscess, menstrual disturbances or even erythema nodosum. In order of importance hemoptysis and pleurisy perhaps take first place because blood-spitting is frequently the first danger signal of the existence of tuberculosis, although it is by no means pathognomonic. It demands careful investigation and adequate rest to insure against future more serious disease. Pleurisy, also, is a frequent early sign. Fatigue, loss of weight and appetite, even cough and sputum, may be due to causes other than tuberculosis, but they are suggestive symptoms and should be investigated and evaluated in the light of other findings. Ischio rectal abscess or fistula-in-ano should be looked upon with suspicion for they are frequently an indication of tuberculosis of the lung.

Physical Examination— The chest should be bared to the waist, the patient in a good light and the examiner

in a comfortable position. A good habit to acquire, is to have a pen in hand recording at once, on the chest and later on a chart, the findings. This necessitates the examiner committing himself and leaves a graphic impression for future reference. On *inspection,* one notes the position of the apex beat, —the presence of fluid, fibrosis, pneumothorax or atelectasis may be responsible for displacing the heart. Localized retraction or lagging of the chest wall will suggest significant change in the underlying lung. *Palpation*—confirms the position of the apex beat, and with both hands flat on the chest, difference in expansion of the two sides can be detected. *Percussion*—With light percussion the heart borders should be mapped out, then interspace by interspace the two sides of the chest should be compared, noting any localized impairment of resonance. To the experienced hand, dullness may be felt as well as heard. There is normally less resonance at the right apex, but diminished resonance in the upper third of the chest means some abnormal process in the underlying lung. Unilateral basal dullness may be due to thickened pleura or fluid or pneumonia. *Auscultation*—On first auscultating the chest, one should listen to breath sounds alone, disregarding any adventitious sounds, concentrating on the pitch and intensity of inspiration and expiration and studying their relative lengths. Interspace by interspace should be covered in this way, comparing the two sides It is most useful to select an area of normal vesicular breathing, in the axilla for instance, and return from time to time to this spot for comparison. Harsh, high pitched prolonged expiration means some increased density in the lung underneath, and in localized areas, this is likely to be due either to fibrosis or congestion. The presence or absence of fever or other signs of activity will help to differentiate which it is. Over cavitation, the breath sounds will be high pitched, depending on whether the cavity communicates with a bronchus. Many cavities cannot be detected with the stethescope because they do not communicate with a bronchus.

When the character of the breath sounds has been studied, one should reexamine the chest in the same way, to determine the presence of rales, at first without cough and later after a cough. This brings out what is known as the "latent rale,' which is very important in detecting early tuberculous lesions. Apical rales are almost always tuberculous, and rales in the upper half of the chest are likely to be due to tuberculosis. Basal rales are more often non-tuberculous but not always so. Generalized rales, dry or moist, are usually due to bronchitis or asthma, or bronchopneumonia. Friction rubs mean pleurisy and about 80% of pleurisies are tuberculous.

Sputum Examination—If positive, this is proof of tuberculosis. If negative it does not mean that the patient has not got tuberculosis. The specimens should be collected in the early morning, definitely raised from the chest and examinations should be repeated many times. If repeatedly negative, concentration tests should be carried out and if these are still negative, guinea pig inoculations will be positive in a certain percentage of cases, not otherwise proven.

X-Ray—Stereoscopic films of the chest are desirable but much can be learned from a flat plate. It is pretty generally conceded today that the X-ray will give evidence of an early lesion long before any other one method will show it up, for it is well known that minimal tuberculosis is most often seen and not heard. Hence the necessity of an X-ray wherever the history or physical examination suggests the possibility of disease. I would even go so far as to say that if all contacts could be X-rayed the percentage of early cases found would be much greater.

For purposes of description, a chest film is divided into three zones—the inner zone, the mid zone, and the outer or peripheral zone. Roughly speaking,

active tuberculosis will cast soft fluffy shadows in the apices or periphery of the upper half of the chest. To this there are many exceptions which it is impossible to describe in this paper. Healing tuberculous shadows are usually strand-like or discretely nodular in character. Healed lesions are brilliant, varying in size from small nodules to large patches. Ring shadows suggest cavity but, in differentiation, localized pneumothoraces, emphysematous blebs beneath the pleura, and cystic disease of lung must be thought of. Diffuse shadows are usually due to thickened pleura or fluid. Consolidation of a lobe may, however, be responsible for this type of shadow. Most upper lobe pneumonias are tuberculous. The shadow of fluid is characteristically triangular in shape with its greatest density in the region of the diaphragm and up along the periphery of the lung, fading from below upwards and medially. Interlobar pleural effusions assume a wedge shape with the apex at the hilus and base at the periphery; if, however, the fluid is under pressure the apex of the shadow may become rounded out. The contour of the diaphragm and costophrenic angles will tell the tale of a pre-existent pleurisy.

Tuberculin Test—A positive tuberculin skin test in an adult means infection, but not necessarily disease. A negative reaction is of value in differential diagnosis of chest conditions.

In conclusion I would like to emphasize once again the importance of early diagnosis in pulmonary tuberculosis. No stone should be left unturned if there is the slightest suspicion in the mind of the physician that the patient might have tuberculosis. X-ray and sputum examinations will solve the problem in the vast majority of cases. The expense of X-ray should be disregarded when one considers the possible future cost if the disease is allowed to become advanced. In Ontario, we are fortunate in having well conducted chest clinics with facilities to assist the physician. However, it is up to him to be well acquainted with the principles of physical examination of the chest in order to detect changes which require further investigation.

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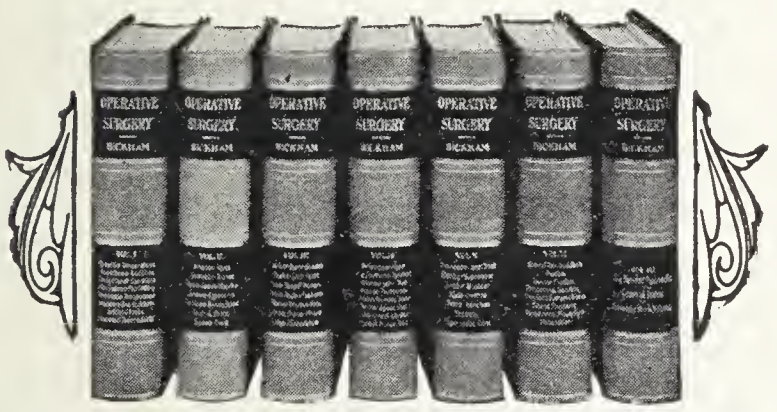

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SYMPATHECTOMY

CHARLOTTE S. SMALL '36

The purpose of this paper is to discuss the efficiency of the removal of portions of the sympathetic trunk, for the alleviation of certain conditions primarily due to vaso-spasm and sphincter spasm.

An enormous amount of physiological research has been done upon the effects of sympathectomy, and while much of the knowledge so gleaned was useful, especially in stimulating the surgeons to experiment in this field, yet our actual knowledge of the results of sympathectomy in man remained very vague until comparatively recently. Even yet conflicting views are held, due chiefly to the published results of animal experimentation, but there are certain conditions where the operation is definitely of value and these will be discussed in brief.

A short review of the anatomy of the sympathetic nervous system might well be introduced at this point. It is composed of two ganglionated trunks which extend from the base of the skull to the tip of the coccyx, just lateral to the mid-line of the body. The ganglia in general, correspond in number with the segments of the spinal cord—i.e. there are usually four to five sacral ganglia, four lumbar, and ten to twelve thoracic. In the cervical region, however, they are generally fused to form three large ganglia.

Various approaches to these trunks have been devised since sympathectomies were introduced. Some of the ganglia are almost inaccessible, but fortunately those which are most commonly removed are quite easily available. These are the upper thoracic, the cervical, and the lumbar ganglia. The lumbar ganglia are generally approached retroperitoneally through the loin, the transperitoneal approach being considered by most surgeons of today as unnecessarily dangerous, due to the opening of the peritoneal cavity.

Some difference of opinion obtains in approaching the cervical ganglia. Many prefer to approach from behind where the trunks are nearer the surface and quite easily found by removal of the head of the second rib; while others feel that it is easier to approach from the front, where one does not have to go through the thick layer of muscle which the posterior approach necessitates. An early operation, that of stripping the plexus from large vessels, is merely mentioned in order to condemn it for its uselessness, since it produces a very limited response, and this response at best is but a transitory one. In spite of this very general opinion, Ross of St. Bartholomew's still uses peri-arterial neurectomy for diabetic and senile gangrene and the trophic ulcers commonly found on arterio-sclerotic patients, claiming some degree of success.

Sympathectomy is used most extensively in children's work in the after treatment of polio myelitis cases. The bluish, moist, cold limbs of the crippled children are well known, and the comfort derived from the dry, warm limbs which follow sympathectomy is in itself worth the operation in the opinion of most patients. However, a further advantage frequently achieved is the increased length of limb which is obtained in many cases of unilateral paralysis, thus improving the gait of the patient, and decreasing the scoliosis and the resulting arthritic deformities of later life.

To remove the entire sympathetic supply to the lower limb, the sympathetic trunk from the twelfth thoracic to the fifth lumbar ganglion must be removed. In early operations only ramisection of the white rami communi-

cantes was performed, but due to the passage of fibres up and down the trunk from one segment to another, this proved to be insufficient.

The classical approach is Royle's, through an S-shaped incision in the loin, from the twelfth rib to the anterior superior spine of the ilium. The lumbar triangle is searched for, and through this the lateral edge of the erector spinae muscle is located. The aponeurosis is divided just lateral to this, from the iliac crest to the twelfth rib. The muscles are separated from the iliac crest. (Some prefer to take a thin slice of cartilage from the crest of the ilium, rather than cut through the very vascular muscle). The muscles are retracted, and the peritoneum separated manually from the psoas fascia, to past the mid-line of the vertebrae. The sympathetic trunk can be seen through the fascia in the angle between the psoas muscle and the aorta on the left, and the vena cava on the right. The fascia is split and the cord lifted from its bed and removed with its branches, from the highest obtainable ganglion, to the one which lies on the pelvic brim. A very useful incision in obese adults is a transverse one, from the umbilicus to the mid-axillary line, a much better exposure being obtained by this means. The optimum time to operate when increased rate of growth in the limb is desired, is just before the normal spurt in growth which children experience—in girls at about twelve years of age, and in boys at thirteen or fourteen.

The increased growth is ascribed to the increased blood supply to the limb, obtained by abolishing the vaso-constrictor sympathetic effect, and some of the results have been remarkably good. An interesting application of the increased growth factor obtains in those cases where sympathectomy has been performed upon normal limbs, where some pathological process has provided an increased blood supply to the other limb over a considerable period of time, producing a noticeable increase in length of the limb. This has occurred with extensive haemangioma of the leg, Brodie's abscess in the upper end of the tibia, chronic osteomyelitis of the tibia, giant-cell tumour of the lower end of the tibia, chronic osteomyelitis of the femur, etc.

There is considerable controversy as to the efficacy of sympathectomy when performed in cases of spastic paralysis, or Little's disease. In some cases the muscle spasm, especially in the adductors, seems to be considerably relieved, but in any case, the legs are dry and warm and not acutely sensitive to cold temperatures as before. The variability in results in these cases may in part be explained by the fact that there are great variations in the mental calibre of these patients, and also the amount of physical disability. Added to this is the fact that we are not yet agreed upon the primary cause of the paralysis—i.e., whether it is a developmental defect or whether there is some underlying pathological change.

In adults, some benefit may be derived from sympathectomy in cases of Buerger's disease, Raynaud's disease, and arterio-sclerosis. In Buerger's disease, no benefit is obtained in the already obliterated vessels, but any associated spasm of the remaining vessels is relieved, thus relieving the pain associated with exercise, or increasing the amount of exercise necessary to produce it. Most cases of Raynaud's disease are greatly improved—they no longer suffer from cold; and the gangrene to which they are so prone is prevented, or if already present, is deterred from progressing to a greater extent. Some cases, however, are not helped, and the temperature of the limb seems to be even more unstable than prior to the operation. Ross claims that this is due to the direct action of the cold upon the small arteries, causing them to contract, even though their vaso-constrictor supply is removed.

The operation which is usually performed is the removal of the first thor-

acic and the inferior cervical ganglia. Henry's approach is probably the most satisfactory—i.e. through a skin incision from the sixth cervical to the fourth thoracic vertebrae, just lateral to the mid-line. The subcutaneous fascia is divided and the muscle split over the transverse processes of the vertebrae. The tip of the second thoracic transverse process is identified, its periosteum split and the process removed, exposing the head of the underlying second rib. The head and neck of this rib are removed subperiosteally. The periosteum and pleura are pushed down with the finger through the opening thus obtained and the sympathetic trunk is seen with the second thoracic enlargement lying across the space. The cord is cut below this ganglia and then the upper segment is pulled down till the first thoracic and inferior cervical ganglia come into view. The cord is cut directly above the latter and removed, thus freeing all fibres to the brachial plexus. Both sides may be done at one sitting and the best anaesthetic is an intratracheal one.

An interesting accompaniment is the Horner's syndrome, which is produced —i.e. a narrowing of the palpebral fissure with constriction of the pupil and cessation of perspiration on that side of the face, together with a dilatation of the retinal vessels, and an increased nasal secretion. There is also a transient lowering of the intraocular pressure which produces visual effects, and may necessitate the wearing of a lens. If bilateral, the syndrome does not spoil the appearance of the patient, but when one-sided it definitely detracts from the comeliness of the face. In this connection, sympathectomy has been used in severe cases of exopthalmus, with varying results.

The absence of perspiration in the sympathectomized part is most interesting, in that the outline between dry and moist areas of skin is very sharply defined. Sympathectomy has been used in patients who complain of excessive perspiration, both of the feet and axillae, but so many patients report increased perspiration in other parts of the body after its cessation in sympathectomized parts, that this operation is not without its disadvantages.

Other conditions of the limbs which may be benefitted by sympathectomy are causalgia, scleroderma and certain cases of arthritis. Causalgia occurs chiefly in connection with the ulnar, median and sciatic nerves—there is considerable pain and the skin is glossy and red or mottled. The condition clears up entirely with sympathectomy. There are several types of scleroderma —the one with a history of cold, clammy, blue extremities is amenable to surgery. The one case operated on at the Hospital for Sick Children, Toronto, had both a lumbar and a cervical sympathectomy performed, which resulted in an improvement in general health, a great increase in energy, with a loss of the lethargy which had been present before and no abnormalities of the skin, which previously had been thick, cyanotic and cold, except that it was always dry and warm. Only a few types of arthritis seem to be benefitted by sympathectomy. Early cases of Still's disease may return to complete normalcy, while later cases may gain considerable relief from pain.

Abdominal conditions which yield good results to sympathectomy are Hirschsprung's disease and visceral pain of various types. Hirschsprung's disease, a congenital dilatation of the colon to an enormous size, probably due to incomplete, intermittent obstruction of the sigmoid colon, rather than to atonia or lack of development or power of colonic muscle, usually responds well to sympathectomy. The operation in itself is not enough, however, for while it makes possible a normal motion, it does not compel it, and unless the evacuations are regular and complete, the colon will gradually fill up again. So it is necessary to have the co-operation of the patient—or his parents, as in most cases it is young children who present themselves— in

the regulation of the bowels for years after operation. Even when the bowels are regular, a fortnightly enema is an excellent means of preventing a recurrence of the condition. Sympathectomy has been used occasionally for the relief of uterine pain, and pain that is of renal origin. In the latter case Ross has practised peri-arterial neurectomy of the renal artery.

Finally, removal of the inferior cervical and upper three thoracic ganglia has been practised with some success for the relief of angina pectoris, where attacks were frequent and very severe.

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SLEEP

By ANN KEYL, '37.

From the earliest times the phenomenon of sleep has been clothed in mystery and superstition. Even now, some people give it a mystic significance. One of the early beliefs was that during sleep the soul left the body and wandered in far-off realms, seeking spiritual spheres. Sudden deaths during sleep were attributed to failure of the soul to return to its body. When superstition had somewhat decreased, men of a more scientific trend of mind started to theorize about the causes of sleep and one very popular idea was that certain humours moistened the brain and produced sleep. From that time on, numerous theories of the cause and nature of sleep have been advanced.

Sleep may be defined as a state of minimal normal activity, both psychic and organic. It is a function of life essential to all organisms—a period of anabolism to allow for repair and reaccumulation of energy, which has been used up during the waking period. A period of "minimal activity" can be noticed from the lowest to the highest forms of life. In the vorticella there is a rhythm of katabolism followed by anabolism, both of which are very short. These organisms have almost no storage capacity for energy and it is produced as needed, which can only be in small amounts and frequent repair or rest periods are necessary. The rhythmicity of the process is one of the most striking factors.

The higher in the scale of evolution we go, the better the neural organization becomes, and energy, both motor and psychic, is needed to fulfill the demands of the organism. Here there is developed a capacity for storing energy, but the period of anabolism still follows activity. In man this mechanism is developed to the highest degree, and great amounts of energy can be stored. Yet there is still the rhythm of katabolism-anabolism.

There is a greater tendency for animals to sleep during the hours of darkness. Sleep is greatly influenced by the reduction of sensory stimuli, and by a feeling of security. During darkness a great sphere of sensory stimuli is abolished. In nature the night is the period of greatest safety as various enemies cannot see each other. No doubt primitive man felt much more secure during the night than in the daytime, when he made a very good target for all his enemies. Hence the habit of sleeping at night may be partially an outcome of evolution.

This period of "minimal activity" called sleep is common to all parts of the body. During normal deep sleep, in a healthy individual, the metabolic

rate is reduced by as much as 15%. Respirations change in character, becoming slower, and frequently thoracic instead of abdominal in type. The gaseous exchange is altered also, the total inspired air being reduced by 40-50%. Oxygen consumption is relatively increased, but carbon dioxide output is decreased.

It has commonly been found that the pulse rate drops somewhat and the blood pressure decreases 15-40 mm. of mercury in the first two hours of sleep, but gradually rises toward the end of sleep. However, observers differ on this point, some saying there is an increase and others a decrease of blood pressure. The cutaneous vessels and probably the splanchnics are dilated, and sweating is more common during sleep (although this has been suggested as being due to poor ventilation). Partial ischaemia of the brain and its coverings has frequently been noted. The blood shows a decrease in calcium and potassium ions. In other words, the circulation is slowed down during sleep.

The alimentary tract shows a reduction in activity, there being less secretion of digestive juices and marked slowing of peristalsis.

The urinary secretion is decreased in amount but the solid elements, especially nitrogenous bodies are increased, and the specific gravity is high.

In the nervous system there are also changes. The threshold for sensory stimuli is raised. There is a complete relaxation of muscles with the exception of the sphincter muscles which retain their tone. Reflexes seem to be reduced, but some workers have noticed no such change. The plantar reflex is frequently dorsi-flexion.

These findings are for a healthy individual in normal deep, quiet sleep. During lighter sleep, however, especially when dreams occur, some of these findings will be changed. The respirations and pulse rate may become very rapid, the blood pressure rise, and muscular activity occur. Blood pressures as high as 200 mm. have been recorded during dreams. Arterio-sclerotic patients also show little drop in their pulse rate and blood pressure.

It may be said that at the present time there is no entirely adequate explanation of what produces sleep. There are however many theories, some of which may be used fairly satisfactorily in finding explanations for sleep disturbances. Some of the more important theories will be discussed.

1. Vascular Theory—Howell enunciated the theory that the amount of blood flowing through the brain was the predisposing cause of sleep. In 1835 Durham showed in dogs with trephine windows in their skulls, that there was a relative ischaemia of the brain. This has been confirmed by some workers but not by others. Certain investigators have noticed that there is a greater volume of blood in the extremities during sleep than during waking. It is well known that the blood pressure decreases somewhat. These facts do not necessarily prove that there is an ischaemia of the brain but they do indicate that the velocity of the blood flow is decreased. Howell believes that in normal sleep the determining factor is vaso-dilatation of the cutaneous vessels, which then allow for lessened blood flow through the brain.

2. Carbon dioxide Theory.— For many years this theory has varied in popularity. It was believed that there was an increase in the amount of carbon dioxide in the body which tended to produce sleep. This was based on the fact that during sleep the carbon dioxide output is decreased. This theory has been the basis for the treatment of certain cases of insomnia. The patient is told to hold his breath as long as possible and to repeat this process until he falls asleep. This treatment has, however, met with indifferent success. Haliburton does not believe that sleep is caused by a poison, but is "a normal manifestation of one stage of the rhythmic activity of the nerve cell."

3. Toxin theory—Piéron has attempted to prove that a toxin liberated by the organism during waking acts on the cells of the central nervous system producing sleep. The substance was called "hypnotoxin" by him. He showed the presence of hypnotoxin in the following experiment:—dogs were deprived of sleep for long periods of time, then some of their blood or cerebrospinal fluid was injected into normal dogs, and the latter showed a tendency to go to sleep. This theory necessitates fatigue to produce the toxin, but it is a well known fact that some people can sleep when not fatigued, and others cannot sleep when greatly fatigued.

4. Neurogenic theories—For many years now, the brain has been thought to be connected with sleep production. Various theories were advanced but most of these have now been discarded.

(a)—In 1895 Duval advanced the hypothesis that the dendritic processes are retracted throughout the entire central nervous system, thus allowing the association processes to be interrupted, and producing sleep. There is however no histological evidence for this, and the theory is not accepted now

(b)—Cajal suggested that instead of the dendritic processes retracting, glial cells, by means of amoeboid movement, interpose themselves between the dendritic processes, and interrupt associations.

(c)—Sleep centre — Many vegetative functions are controlled by centres in the diencephalon and certain workers have turned their attention to the possibility of a sleep centre in that situation also. In some cases of encephalitis which had shown somnolence during life, the post-mortem examination showed lesions in the floor of the third ventricle, walls of the aqueduct of Sylvius, and central grey matter of the fourth ventricle. Others noticed lesions in the thalamus and subthalamus. Therefore, it was argued, a centre controlling sleep must exist in this region.

There is some experimental data which favours the presence of a sleep centre,—

(1)—During sleep there is a decrease in the calcium and potassium ions of the blood. Demale thought that the calcium ions accumulated at the base of the brain, and did some work to prove that calcium here has an effect on sleep. He injected a solution of calcium chloride into the grey matter of the subthalamus in a cat, and the animal promptly went to sleep. Potassium salts similarly injected produced great restlessness, convulsions and coma. He concluded that sleep was regulated from this part of the brain and calcium was in some way concerned.

(2) —Pharmacological analyses of brains of animals which had received large doses of hypnotics showed that the concentration of these was greatest in the thalamus and the floor of the third ventricle, with only traces in the cortex.

(3)—Clinically, somnolence has been observed in several cases of tumours arising in or pressing on the floor of the third ventricle.

5. **Pavlov's theory of inhibition**—While studying the conditioned reflex and how it may be inhibited by another closely allied conditioned reflex, Pavlov turned his attention to the cause of sleep. He stated that sleep is due to an inhibitory process. A very short summary of his explanation is as follows:—the day's activity leads to over-stimulation (fatigue of many cortical points, which then become centres of inhibition. The inhibitory process then spreads from these foci over the cortex and lower cerebral centres, producing a condition of nearly complete cerebral inhibition which is followed by sleep.

From the number of theories of the cause of sleep, it may safely be said that the cause of sleep is unknown. The physiology is fairly well understood and as far as treating disorders of sleep, it is very helpful. However much more work remains to be done before the nature and causes of sleep become properly clarified.

TREATMENT OF INSOMNIA

Treatment of insomnia necessitates a careful history and examination in order to determine the cause or causes, careful judgment to determine the primary factor and then removal or alleviation of this factor. In the meanwhile, drug therapy may be required to carry the patient over the period of investigation.

Broadly speaking, the causes may be classified as:—

1. Psychic—
   (a) Cause known.
   (b) Cause unknown.
2. Bodily discomfort—
   (a) Sensory disturbance.
   (b) Motor disturbance.
   (c) Autonomic disturbance.

In both of these groups, a bad family history may play a part. The individual has not inherited a stable cyclic sleeping habit, and is consequently more easily upset.

Treatment in the cases where the cause is of psychical origin,—such as worry, fear, etc., is psychotherapy, and, if possible, removal of the cause. The patient must be taught not to add worry over his loss of sleep to his other troubles; that it is really not essential to have seven or eight hours of sleep every night. He won't actually suffer if he just lies there with his eyes closed, and his mental and physical condition will be greatly improved by the adoption of a philosophical attitude. In these people, thoughts pass too actively from one subject to another, and chloral hydrate or paraldehyde have been found extremely useful. They appear to decrease this "mental facility."

In these illnesses, such as pneumonia, acute infections or accidents, or any condition where the brain is bombarded with a large number of sensory stimuli, —dyspnoea, discomfort, pain, etc., analgesics are indicated. The best of these are morphine, codeine and heroin.

In conditions, such as hyperthyroidism and chorea, where the motor system is hyperactive, bromides have been found most helpful. In all of these cases of bodily discomfort, of course, the primary cause must not be neglected. When this has cleared up or been removed, the necessity for sedative will quickly decrease, too.

There is a large group of people who suffer from dysfunction of the autonomic nervous system, and are the victims of chronic ill-health. These people present a variety of symptoms from intestinal inco-ordination with spasm of sphincters to tachycardia. This group is helped most by the barbiturates.

In all cases where there is no urgent need to prescribe sedative, one should try the effect of such procedures as a tepid bath, hot milk or cocoa before retiring or moderate open air exercise to bring about relaxation. The patient may also try reading a relatively uninteresting book in bed, and such measures will often restore the sleep cycle without the necessity of giving drugs.

Of all these drugs, it must be remembered that we cannot prophesy that they will work in a given patient, nor is their use specifically limited to the general indications given here. Experience has shown, however, that they are usually most effective when administered as above, provided one's understanding of the cause of the insomnia is correct.

J. F. D.